REMARKS

The present application was filed on May 26, 2006 with claims 1 through 41. Claims 5, 18, 25, and 29 were cancelled in the Amendment and Response to Office Action dated April 28, 2008. Claims 1-4, 6-17, 19-24, 26-28, and 30-41 are presently pending in the above-identified patent application. Claims 22, 26, 30, and 34 are proposed to be amended herein.

In the Office Action, the Examiner rejected claims 1-4, 6, 8-17, 19, 21 and 38-41 under 35 U.S.C. §102(e) as being anticipated by Gardner et al. (United States Publication No. 2005/0233709), rejected claims 7 and 20 under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Kadous et al. (United States Publication No. 2004/0121730), rejected claims 22-28 under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Kadous et al., rejected claims 30-37 under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Giannakis et al. (United States Publication No. 2005/0002461), and rejected claims 31 and 35 under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Giannakis et al. as applied to claims 30 and 35 above, and further in view of Crawford et al. (United States Publication No. 2003/0002471).

The Examiner is thanked for the courtesy of an interview on October 16, 2008 where the Examiner agreed to reconsider the rejection of independent claims 1, 14, 30, 34, and 38 based on the following arguments. The Examiner also indicated that paragraph [0076] of Kadous should have been cited in the rejection of independent claims 22 and 26.

Independent Claims 1, 14, and 38

Independent claims 1, 14, and 38 were rejected under 35 U.S.C. §102(e) as being anticipated by Gardner et al. Regarding claim 1, the Examiner asserts that Gardner discloses wherein each of said subcarriers (paragraphs 0052, lines 6-12) are active on only one of said N antennas at a given time (the receiver operates on only one of the 20 MHz channel(s) to decode part of the packet; paragraphs 0054, lines 4-9).

In the text cited by the Examiner, Gardner teaches:

> [0052] If two adjacent channels are used simultaneously by one device, then there is no need to attenuate the "out-of-band subcarriers" in the middle of this 40 MHz band. An example of this is shown in FIG. 6. The out-of-band subcarriers that are in between the two 20 MHz channels thus need not be attenuated. In FIG. 4, the sequence L_4 is the long training symbol sequence for a 40 MHz preamble, which contains all 128 subcarrier values for a 40 MHz channel long training symbol. *The*

> *first 32 values are identical to the last 32 values of a 20 MHz preamble, corresponding to the subcarriers in the left part of a 20 MHz channel.* One difference between L_4 and two separate 20 MHz long training sequences is that the DC subcarriers are at different locations, so at the position where a 20 MHz channel would normally have its DC subcarrier, the 40 MHz sequence can have a nonzero subcarrier value. In L_4, these are subcarrier numbers 33 and 97, respectively.
>
> [0053] With unattenuated out-of-band subcarriers, signaling information can be carried on those subcarriers during packet setup, such as signaling operating and/or extension modes during a preamble, and additional data can be carried on those subcarriers, to increase the datarate.
>
> [0054] FIG. 7 shows the case of four 20 MHz channels.
>
> [0055] One example of a modified preamble is the preamble shown in FIG. 1 modified as shown in FIG. 8. The long training symbol values for these out-of-band subcarriers can be the same as in the case of FIG. 1. *The long training symbol is followed by a replica of the Signal field with identical subcarrier values in each of the 20 MHz channels. This ensures that a receiver that operates on just one of the 20 MHz channels will still be able to successfully decode at least the first part of the packet containing the Signal field and defer for the rest of the packet, as decoding the Signal field provides the receiver with information about the length of the packet and thus how long to defer.* The same technique can be extended to an arbitrary number of channels.
>
> (Emphasis added.)

As disclosed above and in, for example, paragraph [0006], Gardner acknowledges that a channel is comprised of subcarriers, as would be apparent to a person of ordinary skill in the art. Gardner teaches, however, to operate "*on just one of the 20 MHz channels*." Contrary to the Examiner's assertion, Gardner does *not* disclose or suggest that each of the subcarriers are *active on only one of the N antennas at a given time*. Independent claims 1 and 14 require transmitting from a transmitter having N antennas at least one training symbol using at least one antenna, such that said at least one training symbol can be interpreted by a receiver having M antennas, where M is less than N and *wherein said at least one training symbol comprises a plurality of subcarriers and wherein each of said subcarriers are active on only one of said N antennas at a given time*. Independent claim 38 requires transmitting a legacy preamble having at least one long training symbol and at least one additional long training symbol on each of said N transmit antennas, such that said training symbols can be interpreted by a receiver having M antennas, where M is less than N *wherein said at least one training symbol comprises a plurality of subcarriers and wherein each of said subcarriers are active on only one of said N antennas at a given time.*

Thus, Gardner et al., Kadous et al., Giannakis et al., and Crawford et al., alone or in combination, do not disclose or suggest wherein said at least one training symbol comprises a plurality of subcarriers and wherein each of said subcarriers are active on only one of said N antennas at a given time, as required by independent claims 1, 14, and 38.

Independent Claims 22 and 26

Independent claims 22 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Kadous et al. Regarding claim 22, the Examiner asserts that Gardner discloses wherein a signal field (paragraphs 0005, 0059, and 0078; and FIG. 1) is diagonally loaded across said plurality of transmit antennas (FIGS. 3 and 8; and paragraphs 0022 and 0056).

Applicants note that the present disclosure teaches:

> a method and apparatus are disclosed for transmitting symbols in a multiple antenna wireless communication system, *such that the symbols can be interpreted by a lower order receiver* (i.e., a receiver having a fewer number of antennas than the transmitter). *For example, subcarriers from one or more symbols can be transmitted using a plurality of antennas in the multiple antenna wireless communication system, such that each of the subcarriers are active on only one of the antennas at a given time. In one exemplary implementation, the subcarriers are diagonally loaded across logically adjacent antennas.*
> (Summary of the Invention; emphasis added.)

> FIG. 4 illustrates long training symbols for a MIMO-OFDM system in accordance with the present invention, *where the subcarriers from the training symbol of FIG. 3 are diagonally loaded across three exemplary transmit antennas.* FIG. 4 illustrates the first 16 subcarriers seen at the input of the Inverse Fast Fourier Transform (IFFT) for each of three antennas, $\mathbf{t}_l^1$ through $\mathbf{t}_l^3$, where $\mathbf{t}_l^n$ stands for the long training symbol transmitted on the *n*-th transmit antenna. *In the example shown in FIG. 4, each subsequent subcarrier is transmitted on an adjacent antenna in a round robin fashion. Thus, only one-third of the subcarriers are transmitted on each antenna and the remaining subcarriers are nulled.*
> (Page 5, lines 17-25; emphasis added.)

In the text cited by the Examiner, Gardner teaches:

> [0056] FIG. 8 shows a preamble for a two transmitter MIMO packet. The structure is the same as for 802.11a, but some differences are that a) l_0, l_1, d_0, d_1 may contain out-of-band subcarriers, *b) s_1, l_1, d_1 can be cyclically shifted relative to s_0, l_0, d_0* or c) l_0 and l_1 can contain subcarrier sequences that have a low cross-correlation with the same subcarrier sequences of the 802.11a long training

symbol sequence.
(Emphasis added.)

Contrary to the Examiner's assertion, Gardner does *not* disclose or suggest that a signal field is *diagonally loaded*, as defined in the context of the present invention. In addition, Applicants note that Kadous teaches:

> [0076] FIG. 3A shows the PAC transmission scheme for a spatial multiplexing mode whereby N_T symbol streams are transmitted diagonally from all N.sub.T transmit antennas. For the first symbol stream $\{x_1\}$, the first four symbols $x_{1,1}$, $x_{1,2}$, $x_{1,3}$, and $x_{1,4}$ are transmitted on subbands 1, 2, 3, and 4, respectively, of transmit antennas 1, 2, 3, and 4, respectively. The next four symbols $x_{1,5}$, $x_{1,6}$, $x_{1,7}$, and $x_{1,8}$, wrap around and are transmitted on subbands 5, 6, 7, and 8, respectively, of transmit antennas 1, 2, 3, and 4, respectively. For the second symbol stream $\{X_2\}$, the first four symbols $x_{2,1}$, $x_{2,2}$, $x_{2,3}$, and $x_{2,4}$ are transmitted on subbands 1, 2, 3, and 4, respectively, of transmit antennas 2, 3, 4, and 1, respectively. The next four symbols $x_{2,5}$, $x_{2,6}$, $x_{2,7}$, and $x_{2,8}$ wrap around and are transmitted on subbands 5, 6, 7, and 8, respectively, of transmit antennas 2, 3, 4, and 1, respectively. Similarly, each of the other two symbol streams is transmitted across the N_T transmit antennas and wraps around as many times as needed. As shown in FIG. 3A, the four symbol streams start in the same subband (subband 1) and no zeros need to be padded at the start or the end of the frame.

As noted above, the present disclosure teaches how *an indication of a duration to defer until a subsequent transmission is transmitted, wherein the indication is transmitted such that the indication can be interpreted by a lower order receiver by diagonally loading a SIGNAL field across a plurality of transmit antennas*. The diagonal loading of Kadous, however, does *not* allow for *transmitting an indication of a duration to defer until a subsequent transmission, said indication transmitted such that said indication can be interpreted by a lower order receiver by diagonally loading a SIGNAL field across said plurality of transmit antennas*.

Regarding the definition of a "lower order receiver," Applicants note that this term is well understood in the art and note that a person of ordinary skill in the art would recognize that a "lower order receiver" is a receiver that is capable of receiving data from only a smaller number of transmitted signals than a higher order receiver. For example, United States Patent Numbers 7,436,895 utilizes the term "order" in this context to describe a MIMO receiver. Independent claims 22 and 26, as amended, require receiving an indication of a duration to defer until a subsequent transmission, said indication transmitted such that said indication can be

interpreted by a lower order receiver *by diagonally loading a SIGNAL field across said plurality of transmit antennas*; and deferring for said indicated duration.

Thus, Gardner et al., Kadous et al., Giannakis et al., and Crawford et al., alone or in combination, do not disclose or suggest receiving an indication of a duration to defer until a subsequent transmission, said indication transmitted such that said indication can be interpreted by a lower order receiver by diagonally loading a SIGNAL field across said plurality of transmit antennas; and deferring for said indicated duration, as required by independent claim 22, as amended, and do not disclose or suggest at least one receive antenna for receiving an indication of a duration to defer until a subsequent transmission, said indication transmitted such that said indication can be interpreted by a lower order receiver by diagonally loading a SIGNAL field across said plurality of transmit antennas; and means for deferring for said indicated duration, as required by independent claim 26, as amended.

Independent Claims 30 and 34

Independent claims 30 and 34 were rejected under 35 U.S.C. §103(a) as being unpatentable over Gardner et al. in view of Giannakis et al. Regarding claim 30, the Examiner asserts that Gardner discloses obtaining feedback (paragraph 0007) from at least one receiver indicating a performance (paragraph 0071) for at least one of said N transmit branches (FIGS. 3 and 8; paragraph 0022-0023, 0030-0031, 0056, 0070, and 0072); and adapting one or more parameters of said at least one of the N transmit branches (FIGS. 3 and 8; paragraph 0022-0023, 0030-0031, 0056, 0070, and 0072).

Applicants note that the term "feedback" has a well known definition in the art, as would be apparent to a person of ordinary skill in the art. Applicants also note that, in the text cited by the Examiner, Gardner teaches:

> [0070] A MIMO transmitter can have two or more transmit antennas (or antenna arrays, as the case may be). For a MIMO system with two transmit antennas and two different transmit data streams, preferred values for the cyclic delay values d.sub.k are 0 and 32 samples, respectively. This corresponds to a cyclic delay of 1.6 microseconds between the two transmitters. For three transmitters, d_k can be 0, 22, and 43 samples, respectively. For four transmitters, d_k can be 0, 16, 32, and 48 samples, respectively.
>
> [0071] *At the receiver side, the channel estimates for each transmitter signal can be estimated by a process such as that shown in FIG. 9.* As shown there, the process begins with receiving signals and sampling for the long training symbol (step S1). Then, a 64-point FFT of the received long training symbol samples is

> done (step S2), as is done for conventional 802.11a preamble reception. Next, each subcarrier is multiplied by known pilot values (step S3), and an IFFT of the result is taken to get a 64-point impulse response estimate (step S4).
> [0072] In the case of a MIMO transmission, these 64 samples contain the cyclic shifted impulse responses of all different transmitters. With that, the receiver can isolate the impulse responses for each MIMO transmitter (step S5). For MIMO with two transmit streams, this can be done by separating the first 32 samples and last 32 samples. For four transmit streams, groups of 16 samples can be extracted. (Emphasis added.)

As Gardner teaches in paragraph [0072], the channel estimate is utilized at the receiver. Contrary to the Examiner's assertion, Gardner does *not* disclose or suggest *obtaining feedback at a transmitter from at least one receiver* indicating a performance for at least one transmit branch. Independent claims 30 and 34, as amended, require transmitting one or more symbols from a transmitter having N transmit branches; *obtaining feedback at said transmitter from at least one receiver indicating a performance for at least one of said N transmit branches*; and adapting one or more parameters of said at least one of said N transmit branches.

Thus, Gardner et al., Kadous et al., Giannakis et al., and Crawford et al., alone or in combination, do not disclose or suggest transmitting one or more symbols from a transmitter having N transmit branches; obtaining feedback at said transmitter from at least one receiver indicating a performance for at least one of said N transmit branches; and adapting one or more parameters of said at least one of said N transmit branches, as required by independent claim 30, as amended, and do not disclose or suggest N transmit branches for transmitting one or more symbols; a feedback path for obtaining feedback at said transmitter from at least one receiver indicating a performance for at least one of said N transmit branches; and means for adapting one or more parameters of said at least one of said N transmit branches, as required by independent claim 34, as amended.

Dependent Claims 2-4, 6-13, 15-17, 19-21, 23, 24, 27, 28, 31-33, 35-37 and 39-41

Claims 2-4 and 6-13, claims 15-17 and 19-21, claims 23 and 24, claims 27 and 28, claims 31-33, claims 35-37 and claims 39-41 are dependent on independent claims 1, 14, 22, 26, 30, 34, and 38, respectively, and are therefore patentably distinguished over Gardner et al., Kadous et al., Giannakis et al., and Crawford et al., alone or in combination, because of their dependency from amended independent claims 1, 14, 22, 26, 30, 34, and 38 for the reasons set forth above, as well as other elements these claims add in combination to their base claim.

Conclusion

All of the pending claims, i.e., claims 1-4, 6-17, 19-24, 26-28, and 30-41, are in condition for allowance and such favorable action is earnestly solicited.

If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to contact the undersigned at the telephone number indicated below.

The Examiner's attention to this matter is appreciated.

Respectfully submitted,

Date: October 28, 2008

Kevin M. Mason
Attorney for Applicants
Reg. No. 36,597
Ryan, Mason & Lewis, LLP
1300 Post Road, Suite 205
Fairfield, CT 06824
(203) 255-6560